In the Claims

Please replace all prior versions of claims in the application with the following claims:

1. (Currently amended) A receiver, for use in an OFDM transmission system, having an adaptive channel equalizer means, detector means, equalization parameter updating means, a sampling clock and a sampling clock control means, wherein the equalization parameter updating means responds to outputs of the detector and the adaptive channel equalizer means to provide an equalizer parameter to the adaptive channel equalizer means, the equalization parameter updating means including ambiguity prevention means ~~are provided~~ to prevent said adaptive channel equalizer means from operating on time differences between the receiver and a transmitter which should be corrected by operation of said sampling clock control means,

wherein the equalizer parameter has an equalizer parameter argument function and wherein said adaptive channel equalizer means is prevented from operating on said time differences by forcing a slope of a linear part of the equalizer parameter argument function to be always zero,

wherein said sampling clock has a sampling clock frequency, said adaptive channel equalizer means provides an equalizer output vector U, and said detector means provides a quantized vector Y, and wherein said sampling clock frequency is controlled by a feed-back signal generated from an estimated slope of an argument function, $Y^{*}.U$ which is the element-by-element product of the equalizer output vector U and the conjugate of the quantized vector Y.

2. (Currently amended) A receiver, as claimed in claim 1, wherein said adaptive channel equalizer means provides an equalized data stream and wherein said sampling clock is controlled by data derived from ~~an~~the equalized data stream.

3.-5. (Cancelled)

6. (Currently amended) A receiver, as claimed in claim ~~4~~1, wherein the slope of said equalizer parameter argument function is derived by taking an average slope of the equalizer parameter argument function by unwrapping said equalizer parameter argument function and deriving said average slope from said unwrapped equalizer parameter argument function.

7. (Previously presented) A receiver, as claimed in claim 6, wherein the average slope α_k of the linear part of the equalizer parameter argument function is calculated from:

$$\alpha_k = \frac{1}{N}\sum_n \frac{\angle EQ_{n,k}}{n} \qquad (1a)$$

where $\angle EQ$ is an unwrapped equalizer parameter argument function, n is a carrier index, k is a frame number and N is a size of a frequency domain frame.

8. (Previously presented) A receiver, as claimed in claim 6, wherein the average slope α_k of the linear part of the equalizer parameter argument function is calculated from:

$$\alpha_k = \frac{2}{n_2 - n_0}\left(\sum_{n=n_1=1}^{n_2} \angle EQn,k - \sum_{n=n_0}^{n_1} \angle EQ_{n,k}\right) \qquad (1b)$$

where $\angle EQ$ is an unwrapped equalizer parameter argument function, n is a carrier index, k is a frame number, N is a size of a frequency domain frame, n_1 divides a received frequency band into two equal parts and n_0, and n_2 are lower and upper limits, respectively, of the frequency band.

9. (Currently amended) A receiver, as claimed in claim 8, wherein an input to the adaptive channel equalizer means represents a received signal and wherein, where several separate frequency bands are present in the received signal, equation (1b) is applied to each frequency band separately and the average of the results employed as the slope of the equalizer parameter argument function.

10. (Currently amended) A receiver, as claimed in claim ~~5~~1, wherein said equalizer parameter argument function is rotated in small steps until said slope is zero.

11. (Previously presented) A receiver, as claimed in claim 10, wherein said rotation is performed by using a vector L of complex numbers with unit magnitude and a linear argument function with a slope equal to a small fraction α_k, and wherein L is calculated from:

$$L_{n,k} = \exp(-j.\beta.\frac{n}{N}.\alpha_k) \quad (2)$$

where β controls the speed of adaptation to the zero slope.

12. (Currently amended) A receiver, as claimed in claim ~~5~~1, wherein ~~an~~the equalizer parameter ~~vector~~ EQ is adaptively updated using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_1 . \frac{X^{\bullet}_{n,k}}{|X_{n,k}|^2} . (Y_{n,k} - U_{n,k}) \right] . L_{n,k} \quad (3a)$$

13. (Currently amended) A receiver, as claimed in claim ~~5~~1, wherein ~~an~~the ~~equaliser~~equalizer parameter ~~vector~~ EQ is adaptively updated using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_2 . \frac{X^{\bullet}_{n,k}}{|X_{n,k}|} . (Y_{n,k} - U_{n,k}) \right] . L_{n,k} \quad (3b)$$

14. (Currently amended) A receiver, as claimed in claim ~~5~~1, wherein ~~an~~the ~~equaliser~~equalizer parameter ~~vector~~ EQ is adaptively updated using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_3 . X^{\bullet}_{n,k} . (Y_{n,k}) \right] L_{n,k} \quad (3c)$$

15. (Previously presented) A receiver, as claimed in claim 12, wherein the algorithm defined by equation (3a) is employed during a start up sequence for said receiver.

16. (Currently amended) A receiver, as claimed in claim ~~13~~14, wherein the algorithm defined by equation (3c) is used for tracking slow changes in the ~~adaptive equaliser~~equalizer parameter ~~vector~~ EQ subsequent to a start up sequence for said receiver.

17. (Currently amended) A receiver, as claimed in claim 1, wherein said OFDM transmission system employs DMT.

18. (Currently amended) A receiver, as claimed in claim 1, wherein said OFDM transmission system is an ADSL system.

19. (Currently amended) A receiver, as claimed in claim 1, wherein said OFDM transmission system is a VDSL system.

20. (Currently amended) A receiver, as claimed in claim 1, wherein said OFDM transmission system is a mobile telecommunications system.

21. (Previously presented) An OFDM multi-carrier transmission system having at least one transmitter and a plurality of receivers, wherein said receivers are receivers as claimed in claim 1.

22. (Currently amended) A transceiver, for use in ~~an~~the OFDM transmission system, wherein said transceiver includes ~~a~~the receiver as claimed in claim 1.

23. (Currently amended) In an OFDM transmission system having a transmitter and a receiver, said receiver having an adaptive channel equalizer means, detector means, a sampling clock and a sampling clock control means, and said transmitter having a sampling clock, a

method of maintaining ~~synchronizations~~<u>synchronization</u> between said receiver sampling clock and said transmitter sampling clock, ~~wherein~~<u>comprising:</u>

<u>preventing</u> said adaptive channel equalizer means ~~is prevented~~ from operating on time differences<u> between the receiver and the transmitter</u> which should be corrected by operation of said sampling clock control means<u>;</u>

<u>controlling said adaptive channel equalizer means with an equalizer parameter having an equalizer parameter argument function, and preventing said adaptive channel equalizer means from operating on said time differences by forcing a slope of a linear part of the equalizer parameter argument function to be always zero;</u>

<u>wherein said receiver sampling clock has a sampling clock frequency, said adaptive channel equalizer means provides an equalizer output vector U, and said detector means provides a quantized vector Y, further comprising controlling said sampling clock frequency with a feed-back signal generated from an estimated slope of an argument function, $Y^*.U$ which is the element-by-element product of the equalizer output vector U and the conjugate of the quantized vector Y</u>.

24. (Currently amended) A method, as claimed in claim 23, <u>wherein said adaptive channel equalizer means provides an equalized data stream, </u>comprising controlling said <u>receiver</u> sampling clock with data derived from ~~an~~<u>the</u> equalized data stream.

25.-27. (Cancelled)

28. (Currently amended) A method, as claimed in claim ~~26~~<u>23</u>, comprising deriving the slope of said equalizer parameter argument function by taking an average slope of the equalizer parameter argument function by unwrapping said equalizer parameter argument function and deriving said average slope from said unwrapped equalizer parameter argument function.

29. (Previously presented) A method, as claimed in claim 28, comprising calculating the average slope α_k of the linear part of the equalizer parameter argument function from:

$$\alpha_k = \frac{1}{N}\sum_n \frac{\angle EQ_{n,k}}{n} \qquad (1a)$$

where $\angle EQ$ is the unwrapped equalizer parameter argument function, n is a carrier index, k is a frame number and N is a size of a frequency domain frame.

30. (Previously presented) A method, as claimed in claim 28, comprising calculating the average slope α_k of the linear part of the equalizer parameter argument function from:

$$\alpha_k = \frac{2}{n_2 - n_0}\left(\sum_{n=n_1=1}^{n_2} \angle EQn,k - \sum_{n=n_0}^{n_1} \angle EQ_{n,k}\right) \qquad (1b)$$

where $\angle$ EQ is the unwrapped equalizer parameter argument function, n is a carrier index, k is a frame number, N is a size of a frequency domain frame, n_1 divides the received frequency band into two equal parts and n_0 and n_2 are lower and upper limits, respectively, of the frequency band.

31. (Currently amended) A method, as claimed in claim 30, <u>wherein an input to the adaptive channel equalizer mean represents a received signal,</u> comprising, where several separate frequency bands are present in the received signal, applying equation (1b) to each frequency band separately and employing the average of the results as the slope of the equalizer parameter argument function.

32. (Currently amended) A method, as claimed in claim ~~27~~<u>23</u>, comprising rotating said equalizer parameter argument function in small steps until said slope is zero.

33. (Previously presented) A method. as claimed in claim 32, comprising performing said rotation by using a vector L of complex numbers with unit magnitude and a linear argument function with a slope equal to a small fraction a, and calculating L from:

$$L_{n,k} = \exp(-j.\beta.\frac{n}{N}.\alpha_k) \qquad (2)$$

where β controls the speed of adaptation to the zero slope.

34. (Currently amended) A method, as claimed in claim ~~27~~23, comprising adaptively updating ~~an~~the ~~equaliser~~equalizer parameter ~~vector~~ EQ using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_1 . \frac{X^{\bullet}_{n,k}}{\left| X_{n,k} \right|^2} . (Y_{n,k} - U_{n,k}) \right] . L_{n,k} \qquad (3a)$$

35. (Currently amended) A method, as claimed in claim ~~27~~23, comprising adaptively updating ~~an~~the ~~equaliser~~equalizer parameter ~~vector~~ EQ using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_2 . \frac{X^{\bullet}_{n,k}}{\left| X_{n,k} \right|} . (Y_{n,k} - U_{n,k}) \right] . L_{n,k} \qquad (3b)$$

36. (Currently amended) A method, as claimed in claim ~~27~~23, comprising adaptively updating ~~an~~the ~~equaliser~~equalizer parameter ~~vector~~ EQ using an algorithm defined by:

$$EQ_{n,k+1} = \left[EQ_{n,k} + \mu_3 . X^{\bullet}_{n,k} . (Y_{n,k}) \right] L_{n,k} \qquad (3c)$$

37. (Previously presented) A method, as claimed in claim 34, comprising by employing the algorithm defined by equation (3a) during a start up sequence for said receiver.

38. (Currently amended) A method, as claimed in claim ~~34~~36, comprising using the algorithm defined by equation (3c) for tracking slow changes in the ~~adaptive equaliser~~equalizer parameter ~~vector~~ EQ subsequent to a start up sequence for said receiver.

39. (Currently amended) A method, as claimed in claim 23, wherein said OFDM transmission system employs DMT.

40. (Currently amended) A method, as claimed in claim 23, wherein said OFDM transmission system is an ADSL system.

41. (Currently amended) A method, as claimed in claim 23, wherein said OFDM transmission system is a VDSL system.

42. (Currently amended) A method, as claimed claim 23, wherein said OFDM transmission system is a mobile telecommunications system.

43. (Currently amended) A receiver for use in OFDM transmission system, comprising:

an adaptive channel equalizer for receiving frequency domain input data and producing an equalized signal;

a detector for quantizing the equalized signal and producing a quantized signal;

a sampling clock;

a sampling clock controller for controlling the sampling clock in response to the equalized signal and the quantized signal; and

an equalization controller for controlling the adaptive channel equalizer in response to the frequency domain input data, the equalized signal and the quantized signal, the equalization controller including an ambiguity prevention mechanism for preventing the adaptive channel equalizer from operating on time differences between the receiver and a transmitter which are corrected by operation of the sampling clock controller,

wherein the equalization controller provides an equalization parameter having an equalization parameter argument function and wherein the adaptive channel equalizer is prevented from operating on the time differences by forcing a linear part of the equalizer parameter argument function to be zero; and

wherein the slope of the equalizer parameter argument function is derived by taking an average slope of the equalizer parameter argument function by unwrapping the equalizer parameter argument function and deriving the average slope from the unwrapped equalizer parameter argument function.

44.-45. (Cancelled)

46. (Currently amended) In an OFDM transmission system having a transmitter and a receiver, the receiver including an adaptive channel equalizer, a sampling clock and a sampling clock controller, and the transmitter including a sampling clock, a method in the receiver of

maintaining sychronization between the receiver sampling clock and the transmitter sampling clock, the method comprising;

preventing the adaptive channel equalizer from operating on time differences between the receiver and the transmitter which are corrected by operation of the sampling clock controller;

controlling said adaptive channel equalizer with an equalizer parameter having an equalizer parameter argument function and preventing the adaptive channel equalizer from operating on the time differences by forcing the slope of a linear part of the equalizer parameter argument function to be zero; and

deriving the slope of the equalizer parameter argument function by taking an average slope of the equalizer argument function by unwrapping the equalizer parameter argument function and deriving the average slope from the unwrapped equalizer parameter argument function.

47.-49. (Cancelled)